

Having thus described the preferred embodiments, the invention is now claimed to be:

- 5 1. A two-dimensional radiation detector (30) for a radiographic scanner (12),
the radiation detector (30) comprising:
 a first aligning means (70, 86) for aligning an anti-scatter module (78) with a
spatial focus (74);
 a second aligning means (160, 128, 162) for aligning the anti-scatter module (78)
10 with:
 a detector subassembly module (100), each detector subassembly
module (100) including a substrate (102) and an array (104) of detector
elements arranged on the substrate (102) to detect radiation, and
 a radiation absorbing mask (120) formed as a grid (122, 130) and
15 arranged between the array (104) of the detector elements and the anti-
scatter module (78).
2. The radiation detector (30) as set forth in claim 1, wherein the second
aligning means includes:
20 alignment openings (162) disposed on the substrate (102);
 alignment openings (128) disposed on the radiation absorbing mask (120); and
 alignment pins (160) disposed on the anti-scatter module (78), such that inserting
the pins (160) into the radiation absorbing mask alignment openings (128) and the
substrate alignment openings (162) aligns the detector element array (104) with the
25 radiation absorbing mask (120) and the anti-scatter module (78).
3. The radiation detector (30) as set forth in claim 2, wherein the radiation
absorbing mask (120) is formed of a radiation absorbing material.
- 30 4. The radiation detector (30) as set forth in claim 2, further including:
 one or more of additional radiation absorbing masks (120) stacked on the alignment
pins (160).

5. The radiation detector (30) as set forth in claim 4, wherein the radiation absorbing mask (120) has stepped edges (134), which interleave with stepped edges of adjacent radiation absorbing masks.

5 6. The radiation detector (30) as set forth in claim 1, wherein the anti-scatter module (78) includes:

a plurality of anti-scatter vanes (80) formed of a material which is substantially absorbing for radiation produced by the radiographic scanner (12).

10 7. The radiation detector (30) as set forth in claim 4, wherein the radiation absorbing mask (120) includes:

first strips (122) parallel to the anti-scatter vanes (80), which first strips are wider than a thickness of the anti-scatter vanes (80) and are equal or greater than a gap (124) between the elements of the detector array (104).

15 8. The radiation detector (30) as set forth in claim 1, wherein the radiation absorbing mask (120) includes:

second strips (130) perpendicular to the anti-scatter vanes (80), which second strips are of substantially a same dimension as a gap (132) between the detector elements.

20 9. The radiation detector (30) as set forth in claim 6, wherein the radiation absorbing mask (120) has stepped edges (134), which interleave with stepped edges of adjacent radiation absorbing masks.

25 10. The radiation detector (30) as set forth in claim 1, wherein the radiation absorbing mask (120) defines precise apertures (126), which align with and set a resolution of the elements of the detector array (104).

11. The radiation detector (30) as set forth in claim 10, wherein the apertures (126) are precisely defined by photochemical etching.

12. The radiation detector (30) as set forth in claim 1, wherein the detector element array (104) includes:

a scintillation array (108) that produce scintillation events responsive to radiation produced by the radiographic scanner (12); and

5 a photodetector element array (114), each photodetector element (112) of the array (114) being arranged to view one of the scintillation elements (110) of the scintillation array (108) to convert light from the scintillation events into electrical signals.

13. The radiation detector as set forth in claim 11, wherein the scintillation element array (108) is arranged in a two-dimensional rectangular array with a rectangular array of interfaces between adjoining scintillation elements and the radiation absorbing mask (120) includes:

a rectangular array of strips (122, 130) of a radiation absorbent material that defines the grid, the strips overlying interfaces (124, 132)
15 between adjacent scintillation elements.

14. A computed tomography scanner (12) including:

an x-ray source (14) mounted to rotate about an examination region (18), the x-ray source emitting a cone shaped x-ray beam from a radiation focal point and traversing the examination region (18);
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a two-dimensional radiation detector (30) which receives the cone beam of radiation that has traversed the examination region, the radiation detector (30) including a plurality of detector modules (32), each detector module including:

an anti-scatter module (78),
25 a detector subassembly module (100) aligned with the anti-scatter module (78), each detector subassembly module (100) including a substrate (102) and an array (104) of detector elements arranged on the substrate (102) to detect radiation, and

a radiation absorbing mask (120) formed as a grid (122, 130), the mask being arranged between and aligned with the array (104) of the detector elements and the anti-scatter module (78); and
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a reconstruction processor (42) for reconstructing signals from the detector element array (104) into a volumetric image.

15. A method for manufacturing a radiation detector (30) for a computed tomography scanner (12), the method comprising:

5 aligning an anti-scatter module (78) with:

a detector subassembly module (100) including a substrate (102) and an array (104) of detector elements arranged on the substrate (102) to detect radiation, and

10 a radiation absorbing mask (120) disposed between the anti-scatter module (78) and the detector elements of the array (104).

16. The method as set forth in claim 14, further including:

forming a radiation absorbing mask (120) by photoetching a radiation opaque material to define a grid.

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17. The method as set forth in claim 14, wherein the anti-scatter module includes extending alignment pins (160) and the aligning step includes:

inserting the alignment pins through alignment openings (128) in the mask and alignment openings (162) in the detector subassembly module (100).

20 18. The method as set forth in claim 17, wherein the scanner (12) includes an x-ray source (14) on a rotating gantry (22) that produces a cone of x-rays, which pass through an examination region (18) and strike the radiation detector (30), the method further including:

25 mounting the anti-scatter module (78) onto the computed tomography scanner (12), with a spatial focal point (74) of the anti-scatter module being aligned with a focal point of the x-ray source prior to inserting the pins (160) into the alignment openings (128, 162) of the mask and the detector subassembly module (100).

30 19. The method as set forth in claim 17, wherein as the pins are inserted in the alignment openings (128) of the radiation absorbing mask (120), edges of adjacent radiation absorbing masks (120) are interleaved.

20. The method as set forth in claim 15, further including:
defining uniform apertures (126) in the radiation absorbing mask (120) to precisely
fix an amount of radiation received by each detector element of the array (104).

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21. An alignment apparatus (78, 120) for a radiation detector (30) of a
radiographic scanner (12), the radiation detector (30) includes a plurality of detector
modules (32), each detector module (32) including:

an anti-scatter module (78), including a plurality of vanes (80); and
10 a rectangular grid (122, 130) including:
a plurality of wider strips (122), arranged parallel to each other, each wider
strip being wider than a width of each vane (80), and
a plurality of thinner strips (130), the plurality of thinner strips (130) being
arranged perpendicular to the wider strips (122) to form uniform openings (126),
15 each wider strip (122) is aligned with a corresponding vane (80).

22. The apparatus as set forth in claim 21, further including:

a detector array (104) including a plurality of detector elements arranged to form a
multi-dimensional rectangular array, each two adjoining detector elements of the array
20 (104) being separated by interfaces (124, 132), the interfaces (124, 132) are aligned with
the rectangular grid (122, 130) to place the grid openings (126) between the vanes (80) and
the detector elements of the array (104) to define resolution of the radiographic scanner
(12).